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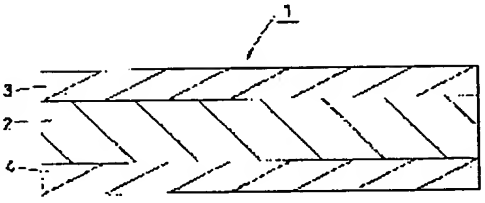
(54) HEAT-CONDUCTIVE SHEET

(57)Abstract:
PROBLEM TO BE SOLVED: To obtain a heat-conductive sheet provided with an adhesive layer having thermal conductivity equal to a fixed value or above in which the adhesive layer is bondable even at a room temperature and with an adhesive layer having flexibility.
SOLUTION: This heat-conductive sheet comprises a heat-conductive filler at least on one side of a sheetlike material having ≥10 W/m.K coefficient of thermal conductivity and the adhesive layer which is bondable at room temperature, has 1.0×104-1.0×107 Pa shear storage elastic modulus and is laminated to the sheetlike material.



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CLAIMS

[Claim(s)]
[Claim 1] The thermally conductive sheet with which it adhered at the room temperature and the laminating of the adhesive layer whose shear storage modulus is 1.0x104 to 1.0x107Pa was carried out while the heat-conduction filler was included at least in one side of the sheet-like object of 10 or more W/m-K of thermal conductivity.
[Claim 2] The thermally conductive sheet according to claim 1 whose thermal conductivity of an adhesive layer is 5 or more W/m-K.
[Claim 3] The thermally conductive sheet according to claim 1 or 2 with which the adhesion of one adhesive layer differs from the adhesion of the adhesive layer of another side while the laminating of the adhesive layer is carried out to both sides of a sheet-like object.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the thermally conductive sheet with which the laminating of the adhesive layer was carried out.
[0002]
[Description of the Prior Art] For example, it installs in heating elements, such as electrical and electric equipment and electronic parts, and high temperature conductivity sheets, such as aluminium foil, are used so that heat may be conventionally transmitted from a heating element to a radiator article efficiently as heat-conduction material which has the role told to the heat sink which makes the heat of the heating element handed down by this heating element radiate heat. When installing a high temperature conductivity sheet between said heating elements and heat sinks and the adhesive layer is formed in both sides of said high temperature conductivity sheet, since it can paste up easily, it is desirable.
[0003] However, since adhesion ingredients, such as resin which generally forms an adhesive layer, have bad thermal conductivity, they have a possibility of checking the thermal conductivity which the high temperature conductivity sheet has. For this reason, in addition to said adhesion ingredient, the thermally conductive sheet which comes to carry out the laminating of the adhesive layer made to form with the adhesion matter which made high temperature conduction ingredients, such as a thermally conductive filler, contain to a high temperature conduction sheet is known. (Refer to JP,2-102452,U)
[0004]
[Problem(s) to be Solved by the Invention] However, the adhesive layer containing the high temperature conduction ingredient by which the laminating is carried out to the conventional thermally conductive sheet will become what has the inadequate adhesion to this member, when it does not have sufficient flexibility but it is made to install it in other members. The thermally conductive sheet with which it comes to carry out the laminating of the adhesive layer containing the high temperature conduction ingredient of the type which will be in the condition which can be pasted up by heating on the other hand is also known.
[0005] However, since the thermally conductive sheet equipped with the such type adhesive layer did not have adhesiveness if it is not heated, it was unsuitable for attaching in a heating element with a possibility of producing un-arranging by applying heat, such as IC.
[0006] Then, this invention is made in view of the above-mentioned problem, and while having the adhesive layer which has the thermal conductivity more than predetermined, this adhesive layer can stick also at a room temperature, and it aims at offering the thermally conductive sheet equipped with the supple adhesive layer.
[0007]
[Means for Solving the Problem] In order to solve the above-mentioned problem, the heat-conduction material (it is hereafter described as "the heat-conduction material of claim 1".) concerning claim 1 of this invention stuck at the room temperature, and was taken as the configuration to which the laminating of the adhesive layer whose shear storage modulus is 1.0x104 to 1.0x107Pa was carried out while it contained the heat-conduction filler at least in one

side of the sheet-like object of 10 or more W/m-K of thermal conductivity.
[0008] In the above-mentioned configuration, especially with the sheet-like object of 10 or more W/m-K of thermal conductivity, although not limited, metal sheets, graphite sheets, etc., such as copper and aluminum, are mentioned, for example. As for a sheet-like object, at this time, it is desirable that thermal conductivity is 200 or more W/m-K. Moreover, it may be smooth, irregularity may be prepared and a sheet-like object is not limited especially. When irregularity is prepared in the sheet surface of a sheet-like object, although this shape especially of toothing is not limited, a configuration in which a cross-section wave type and the irregularity of a cross-sectional-view rectangle are prepared by turns is mentioned, for example. Moreover, as for the thickness of a sheet-like object, it is desirable to carry out about 10 - 90% of thickness of the thermally conductive whole sheet.
[0009] Although it will not be especially limited if the adhesive layer in this invention is in the range whose shear storage modulus it is a room temperature and is 1.0x104 to 1.0x107Pa, it is desirable that it is in the range of 1.0x104 to 1.0x106Pa, and it is more desirable that it is in the range which is 1.0x104 to 1.0x105Pa. That is, if a shear storage modulus is smaller than 1.0x104Pa, cohesive force will be too low, the paste remainder to a base material or adherend will occur, and user-friendliness will worsen. On the other hand, if a shear storage modulus is larger than 1.0x107Pa, flexibility will become scarce and adhesion will worsen. Therefore, the contact nature in an interface with adherend will become small, and will degrade thermal conductivity.
[0010] The above-mentioned adhesive layer can be formed by making it filled up with the thermally conductive filler which has high temperature conductivity into thermoplastic binder resin. Although especially the blending ratio of coal of binder resin and a heat-conduction filler is not limited, it is desirable that 90 capacity % - 50 capacity % and a thermally conductive filler are blended with 10 capacity % - 50 capacity % extent for binder resin.
[0011] Although especially the thermal conductivity of the adhesive layer at this time is not limited, like the heat-conduction material (it is hereafter described as "the heat-conduction material of claim 2".) concerning claim 2 of this invention, a certain thing is [5 or more W/m-K of thermal conductivity] desirable, and a certain thing is still more desirable 10 or more W/m-K.
[0012] Moreover, like the heat-conduction material (it is hereafter described as "the heat-conduction material of claim 3".) concerning claim 3 of this invention, when the laminating of the adhesive layer is carried out to both sides of a sheet-like object, while the laminating of the adhesive layer is carried out to both sides of a sheet-like object, it is desirable to make it the adhesion of one adhesive layer differ from the adhesion of the adhesive layer of another side. Exchange can be done easily, without damaging a thermally conductive sheet, when are done in this way, for example the thermally conductive sheet concerning this invention is used as a heat-conduction layer of the clearance between a semi-conductor and a heat sink and a semi-conductor is renewed by strengthening adhesion of a contact part with a heat sink, and weakening adhesion of a contact part with a semi-conductor. Incidentally, the adhesion at this time is a room temperature, and it is desirable 300gf(s) / to make weaker than 25mm 300gf(s) / adhesion of an adhesive layer by which strengthens and the laminating is carried out to the field of another side from 25mm in the adhesion of the adhesive layer by which the laminating is carried out to one field of a sheet-like object.
[0013] Although not limited, especially as a heat-conduction filler, for example Moreover, gold, Particles, such as metals, such as copper, silver, iron, aluminum, cobalt, tin, nickel, titanium, and an indium, and various alloys; An aluminum oxide (alumina), Oxides particles, such as a zinc oxide, magnesium oxide, beryllium oxide, titanium oxide, and indium oxide tin (ITO); Boron nitride, Carbide particles, such as nitrides particle; silicon carbide, such as silicon nitride and aluminium nitride, a graphite, a diamond, amorphism carbon, carbon black, and a carbon fiber; silica powder particles, such as a quartz and quartz glass, etc. are mentioned. However, when using a thermally conductive sheet for the application which needs insulation, since it is inferior to insulation, it is desirable [metal system fillers, such as the above-mentioned metal and various alloys,] to use other inorganic fillers.
[0014] Moreover, when using scale-like particles, such as boron nitride, and spherical particles,

such as silicon carbide and nitriding aluminum, and it is made to use as a heat-conduction filler combining the ratio of said scale-like particle and spherical particle at 1 / about nine to 9/1 rate, since high thermal conductivity can be obtained, it is desirable.
[0015] Moreover, as for the particle size of a heat-conduction filler, it is desirable that it is 0.05 micrometers - 50 micrometers, and it is more desirable that it is 0.1 micrometers - 20 micrometers. That is, if filler particle size is smaller than 0.05 micrometers, secondary condensation will arise, the distribution to a binder will become difficult, and when filler particle size is larger than 50 micrometers, and the glue line of a thin film is made to form, there is a possibility that surface ARE may occur. Moreover, when particle size uses a heat-conduction filler 15 micrometers or more, it is desirable that the combination rate of a heat-conduction filler makes it fewer than 20 capacity %. That is, in more than 20 capacity %, when the glue line of a thin film is made to form, there is a possibility that surface ARE may occur.
[0016] Moreover, especially as binder resin made to fill up with the above-mentioned heat-conduction filler, although not limited, it is desirable to use acrylic resin excellent in adhesiveness. The above-mentioned acrylic resin carries out the polymerization of the acrylic ester which has the alkyl group of carbon numbers 1-14 (meta), and is obtained. As these (meta) acrylic ester, a methyl acrylate (meta), Lil acid ethyl, acrylic-acid (meta) n-propyl, acrylic-acid (meta) isopropyl, acrylic-acid (meta) n-butyl, acrylic-acid (meta) Sec-butyl, acrylic-acid (meta) t-butyl, cyclohexyl methacrylate, acrylic-acid (meta) n-octyl, acrylic-acid iso octyl, 2-ethylhexyl acrylate (meta), acrylic-acid iso nonyl, acrylic-acid (meta) lauryl, etc. are mentioned, for example. in addition -- an acrylic (meta) -- an expression names an acrylic and methacrylic one generically. Only one sort may be used and two or more sorts of acrylic ester (meta) mentioned above may be used together.
[0017] Moreover, the above-mentioned acrylic resin may carry out copolymerization of other vinyl monomers, in order to adjust the glass transition temperature of resin and the polarity which are acquired. As such a copolymerizable vinyl monomer The styrene monomer represented by alpha methyl styrene, vinyltoluene, styrene, etc.; The methyl vinyl ether, The vinyl ether system monomer represented by ethyl vinyl ether and isobutyl vinyl ether; A fumaric acid, The monoalkyl ester of a fumaric acid, the dialkyl ester of a fumaric acid, The monoalkyl ester of a maleic acid and a maleic acid, JIARUKIRUESUERU of a maleic acid, Unsaturated carboxylic acid, such as monoalkyl ester, or unsaturated-carboxylic-acid alkyl ester of an itaconic acid and an itaconic acid; (meta) Acrylic nit nil, A butadiene, an isoprene, a vinyl chloride, a vinylidene chloride, vinyl acetate, a vinyl ketone, vinyl pyrrolidone, vinylpyridine, acrylamide (meta), vinylcarbazole, etc. can be mentioned.
[0018] As a copolymerization component, an end is embellished with the partial saturation double bond of the polymerization nature of a radical, number average molecular weight is 800-30000, and, as for the above-mentioned acrylic resin, it is desirable to carry out the graft copolymerization of the polymer (for it to be hereafter described as Polymer A.) whose glass transition temperature is 30 degrees C or more. Since the copolymerized segment of high glass transition temperature forms a freezing phase and acts as false bridge formation by such graft copolymerization, the strong acrylic resin of cohesive force can be obtained and the adhesive layer which was excellent in holding power using this acrylic resin can be obtained. Moreover, the acrylic resin obtained as mentioned above is a hot melt type, its freezing phase is thermally reversible, and since it fuses above glass transition temperature, it can perform easily melting kneading with a thermally conductive filler, and hot melt coating by extrusion molding.
[0019] As the above-mentioned polymer A, it has other polymerization nature monomers and a copolymerizable double bond, number average molecular weight is 800-30000, and if glass transition temperature is 30 degrees C or more, it will not be limited especially. That is, since the cohesive force as a polymer is not acquired, but a polymerization becomes difficult when larger than 30000 when the number average molecular weight of Polymer A is smaller than 800, it is not desirable. Moreover, when the glass transition temperature of Polymer A is smaller than 30 degrees C, since condensing [of a freezing phase] becomes inadequate [ordinary temperature] and the cohesive force as a polymer is not acquired, it is not desirable.
[0020] In addition, other polymerization nature monomers and a copolymerizable double bond

mean the partial saturation double bond of radical polymerization nature, and a vinyl group, an acryloyl (meta) radical, an allyl group, etc. are mentioned here as a functional group which has such a double bond. as the concrete example of Polymer A -- for example, the Toagosei chemistry company make --; trade name:AA-6 are mentioned.
[0021] When carrying out copolymerization of the polymer A to acrylic resin, as for the rate in the acrylic resin of Polymer A, it is desirable that it is the 5 - 100 weight section to the acrylic ester 100 weight section, and its 10 - 30 weight section is more desirable. That is, when there are few rates of Polymer A than 5 weight sections, the cohesive force as a polymer is not acquired, but when [than the 100 weight sections] more, gelation is caused and practicality falls.
[0022] Moreover, the above-mentioned acrylic resin may introduce bridge formation, in order to heighten cohesive force. The chemistry bridge formation using cross linking agents, such as an isocyanate cross-linking agent, an aziridine system cross linking agent, and an epoxy cross-linking agent, as the technique of bridge formation is mentioned. Moreover, it may be made to give optical bridge formation by the exposure of radiation-induced crosslinking, such as an electron ray, ultraviolet rays, etc. Moreover, by performing kneading and mixing for acrylic resin and a thermally conductive bulking agent in the state of no constructing a bridge, more thermally conductive bulking agents can be blended, by using the resin constituent obtained in this way as an adhesive layer, a laminating can be carried out to a sheet-like object and the thermally conductive sheet equipped with the adhesive layer excellent in thermal conductivity and adhesiveness can be obtained by back-constructing a bridge. To the above-mentioned acrylic resin, tacky fires, such as petroleum resin, hydrogenation petroleum resin, coumarone-indene resin, and rosin resin, may be added. Thus, if a tacky fire is added, an adhesive high adhesive layer can be formed more.
[0023] Although the above-mentioned acrylic resin can be obtained by the approach of arbitration, such as solution polymerization and a bulk polymerization, it can dissolve acrylic-acid (meta) alkyl ester in suitable solvents, such as ethyl acetate, and can usually be easily obtained by the solution polymerization method using a polymerization initiator. Moreover, the approach of carrying out a polymerization may be used by irradiating ultraviolet rays into the inert atmosphere of nitrogen etc. to the non-solvent liquefied mixture containing acrylic-acid (meta) alkyl ester and a photopolymerization initiator.
[0024] Moreover, especially although not limited especially as molecular weight of the above-mentioned acrylic resin, it is desirable that it is the thing of 10,000-4 million. That is, when molecular weight is smaller than 10,000, the reinforcement of the resin constituent obtained and elongation will fall. On the other hand, when molecular weight is larger than 4 million, kneading with a thermally conductive filler will become difficult, and the reinforcement of the resin constituent obtained will fall.
[0025] Moreover, the glass transition temperature of acrylic resin has -120 degrees C - desirable 20 degrees C, and -100 degrees C - especially its 0 degree C is desirable. That is, composition of thermoplastics is difficult when glass transition temperature is lower than -120 degrees C. When glass transition temperature is higher than 20 degrees C, the flexibility of the resin constituent obtained will fall and it will become impossible on the other hand, to acquire sufficient adhesiveness in ordinary temperature.
[0026] Moreover, especially although especially the viscosity of acrylic resin does not receive a limit, it is desirable that it is 100cps - 100,000cps. That is, in case you make it it filled up with a filler that viscosity is less than 100cps and it is made to knead and mix, a shear is not transmitted, but filler particles condense or it is [it does not distribute but] hard coming to be mixed with homogeneity in base resin. On the other hand, it does not distribute but will be hard coming to be mixed as viscosity will become high too much and a fill will be increased, if viscosity exceeds 100,000cps.
[0027] Although especially the thickness of a thermally conductive sheet is not limited, it is desirable that it is 20 micrometers - 800 micrometers, and it is more desirable that it is 30 micrometers - 180 micrometers. That is, if the thickness of a thermally conductive sheet is smaller than 20 micrometers, the effectiveness made to follow in footsteps to the clearance

between a heating element and a heat sink will become inadequate, and interface thermal resistance will rise. On the other hand, if the thickness of a thermally conductive sheet is larger than 20 micrometers, since the transfer distance of heat will become long, a thermal resistance value will rise.
[0028] Moreover, since reinforcement is increased, you may make it compound a thermally conductive sheet with reinforcing materials. Here, especially as reinforcing materials, although not limited, metal plates, such as glass fabrics, an aluminum plate, and a copper plate, a metal mesh, etc. are mentioned, for example. Furthermore, the thermally conductive sheet may be carrying out what kind of field configuration, and may pierce and use it for the configuration of arbitration according to the purpose of use.
[0029] In addition, as for a thermally conductive sheet, it is desirable to deal with it with wrapping, such as a releasing paper, from viewpoints, such as handling at the time of pasting to adherend, transportation, and preservation and prevention of contaminant adhesion, as it packs. Especially as the above-mentioned packing material, although not limited, a polyethylene film, a polypropylene film, a polyethylene terephthalate (PET) film, a Teflon (trademark) film, a glass-fabrics reinforcement Teflon film, a paper base, etc. are mentioned, for example.
[0030]
[Embodiment of the Invention] Hereafter, the gestalt of operation of the heat-conduction material concerning this invention is explained with a drawing. Drawing 1 is the side view sectional view having shown the gestalt of 1 operation of the thermally conductive sheet concerning this invention.
[0031] As shown in drawing 1 , as for the thermally conductive sheet 1, the laminating of an adhesive layer 3 and the adhesive layer 4 is carried out to both sides of the metal sheet 2 as a sheet-like object. The metal sheet 2 is formed with the smooth aluminum sheet whose thickness is 10 micrometers - 100 micrometers.
[0032] The adhesive layer 3 and the adhesive layer 4 have the thermal conductivity of 5 or more W/m-K while the shear storage modulus is all 1.0x104 to 1.0x107Pa at the room temperature (0-30 degrees C). Moreover, an adhesive layer 3 is formed with the acrylic resin which is doing 10-50 capacity % content of a nitride particle and a carbide particle as a heat-conduction filler, and has 300gf(s) / strong adhesion from 25mm at the room temperature. Moreover, an adhesive layer 4 is formed with the acrylic resin which is doing 10-50 capacity % content of a nitride particle and a carbide particle as a heat-conduction filler, and has 300gf(s) / adhesion weaker than 25mm at the room temperature.
[0033] Even if this thermally conductive sheet 1 is a room temperature, it can be made to stick on each part material easily, having the outstanding thermal conductivity, when making it fasten between electronic parts, such as IC, and radiator articles, such as a heat sink, since it is as mentioned above. And since the adhesion of an adhesive layer 3 and an adhesive layer 4 differs, while being stabilized in a heat sink and stuck by making it stick so that the strong adhesive layer 3 of adhesion may be contacted to a heat sink and the weak adhesive layer 4 of adhesion may be contacted to electronic parts, such as IC, also when exchanging IC etc., it can exchange easily, without damaging this thermally conductive sheet 1.
[0034]
[Example] The example of this invention is explained in more detail below.
As opposed to the acrylic ester copolymer as binder resin which carried out the polymerization of the 2-ethylhexyl acrylate 90 weight section and the acrylic-acid 10 weight section, and obtained them (Example 1) the boron nitride (the DENKI KAGAKU KOGYO K.K. make, grade SGP mean particle diameter of 18 micrometers) as a thermally conductive filler -- 65 weight sections and silicon carbide (the Yaku Islands electrical engineering company make --) grade OY-15 mean particle diameter of 5 micrometers -- 24 weight sections -- in the adhesion material (heat-conduction filler content 30 capacity %) 100 weight section which each mixed and was obtained Coating desiccation of the coating solution which added the ethyl-acetate 400 weight section as a solvent was carried out to both sides of a smooth aluminum plate with a thickness of 50 micrometers by the multi-coating machine, and the thermally conductive sheet with a thickness [of the whole which has a 15-micrometer adhesive layer to both sides] of 80 micrometers was

obtained. In addition, even if the obtained thermally conductive sheet was a room temperature (23 degrees C), it showed sufficient adhesion, and it was excellent in handling nature.
[0035] (Example 2) an acrylic ester copolymer -- receiving -- the boron nitride (the DENKI KAGAKU KOGYO K.K. make --) as a thermally conductive filler the grade SGP mean particle diameter of 18 micrometers -- 38 weight sections and silicon carbide (the Yaku Islands electrical engineering company make --) grade OY-15 the mean particle diameter of 5 micrometers -- 14 weight sections -- the thermally conductive sheet with a thickness [of the whole which has a 15-micrometer adhesive layer to both sides] of 80 micrometers was obtained like the example 1 except having each mixed and having obtained adhesion material (heat-conduction filler content 20 capacity %). In addition, even if the obtained thermally conductive sheet was a room temperature (23 degrees C), it showed sufficient adhesion, and it was excellent in handling nature.
[0036] (Example 1 of a comparison) an acrylic ester copolymer -- receiving -- the boron nitride (the DENKI KAGAKU KOGYO K.K. make --) as a thermally conductive filler the grade SGP mean particle diameter of 18 micrometers -- the 355 weight sections and silicon carbide (the Yaku Islands electrical engineering company make --) grade OY-15 the mean particle diameter of 5 micrometers -- the 128 weight sections -- the thermally conductive sheet with a thickness [of the whole which has a 15-micrometer adhesive layer to both sides] of 80 micrometers was obtained like the example 1 except having each mixed and having obtained adhesion material (heat-conduction filler content 70 capacity %). In addition, the obtained thermally conductive sheet lacked in the flexibility of an adhesive layer at the room temperature (23 degrees C), and its handling nature was very bad.
[0037] (Example 2 of a comparison) To the acrylic ester copolymer, a thermally conductive filler was not added but the thermally conductive sheet with a thickness [of the whole which has a 15-micrometer adhesive layer to both sides] of 80 micrometers was obtained like the example 1 except having obtained adhesion material (heat-conduction filler content 0 capacity %). In addition, even if the obtained thermally conductive sheet was a room temperature (23 degrees C), it showed sufficient adhesion, and it was excellent in handling nature.
[0038] Using the measuring device S which showed each of the thermally conductive sheet in the above example 1, an example 2 and the example 1 of a comparison, and the example 2 of a comparison to drawing 2 R> 2, as it was the following, the thermal resistance value was measured. Measurement of the thermal resistance value using a measuring device S put the heat-conduction material s2 used as a sample on the condensator s1 made from aluminum, and put IC (made in South Korea: 7805 UC8847, electric-energy 3.5W) used as a heat source on it further.
[0039] The temperature of T1 part 5 minutes after binding tight by bolting torque 1 N/m and putting a power source into IC with a bolt s3 in the above condition, and T2 part was measured. In addition, circulation supply of the condensator s1 is carried out in 23-degree C water from a constant temperature bath s4 inside. Moreover, count of a thermal resistance value was performed by [as being the following].
Thermal resistance value (degree C/W) =(T1-T2)/(the amount of supply voltages to IC)
[0040] Moreover, the shear storage modulus was measured at the frequency of 10Hz, and the temperature of 23 degrees C by (: mechanical spectrometer RMS[by REOMETO Rix Corp.]-800/RDSII). The above result was shown in Table 1.
[0041]
[Table 1]

	熱伝導フィラー含量 (容量%)	貯蔵剪断弾性率 (Pa)	熱抵抗値 (℃/W)
実施例1	30	9×10⁴	0.18
実施例2	20	4×10⁵	0.19
比較例1	70	2×10⁷	0.31
比較例2	0	8×10⁴	0.89

[0042] In addition to having the outstanding heat-conducting characteristic, the result of Table 1 shows that it has flexibility with a moderate adhesive layer, even if the thermally conductive sheet obtained in the example 1 and the example 2 is a room temperature. On the other hand, the shear storage modulus in a room temperature is too large, and not only the thermally conductive sheet obtained in the example 1 of a comparison has bad handling nature, but since the flexibility of an adhesive layer is missing, in spite of containing the heat-conduction filler in large quantities, it turns out that thermal resistance is large. Moreover, the example 2 of a comparison has very bad heat-conducting characteristic, and it cannot use it as heat-conduction material.
[0043]
[Effect of the Invention] The thermally conductive sheet concerning claim 1 and claim 2 of this invention is excellent in thermal conductivity, in order that an adhesive layer with a moderate shear storage modulus may secure interface adhesion with other members while having high temperature conductivity when making this thermally conductive sheet stick on other members since it is constituted as mentioned above. Moreover, since this adhesive layer sticks at a room temperature, handling nature is also excellent, and it can do easily the activity to which a thermally conductive sheet is made to stick on other members. Moreover, since the adhesion of the adhesive layer by which the laminating is carried out to both sides of a sheet-like object differs, the thermally conductive sheet concerning claim 3 of this invention can perform changing of a semi-conductor etc. easily.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the side view sectional view having shown the gestalt of 1 operation of the heat-conduction material concerning this invention.
[Drawing 2] It is the schematic diagram of the equipment which measures a thermal resistance value.
[Description of Notations]
1 Thermally Conductive Sheet
2 Sheet-like Object
3 Adhesive Layer
4 Adhesive Layer

[Translation done.]